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John Deere foundry, Waterloo, Melt Operations Department : induction furnace safety operational procedures

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John Deere Foundry Waterloo
Melt Operations Department
Induction Furnace Safety Operational Procedures

A Graduate Project

Submitted to the

Division of Communication and Training Technology

Department of Curriculum and Instruction

in Partial Fulfillment

of the Requirements for the Degree

Master of Arts

UNIVERSITY OF NORTHERN IOWA

by

Edwina J. Boston

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This Project by: Edwina J. Boston

Titled: John Deere Foundry Waterloo
Melt Operations Department
Induction Furnace Safety Operational Procedures

has been approved as meeting the research requirement for the Degree of Master of Arts.

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July 30, 1998
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Abstract

The use of multimedia technologies as training tools allows businesses to reduce training time, decrease costs, increase accessibility, provide active learning experiences, and increase safety. The Induction Furnace Operational Procedures Unit is a set of eight (8) instructional modules developed for the John Deere Waterloo Works Foundry, Melt Operations Department. These modules were developed for use in the training of employees on the safety and operational procedures for using an induction furnace.

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Introduction

The Induction Furnace Safety Operational Procedures Unit is a set of eight (8) instructional modules developed for the John Deere Waterloo Works Foundry, Melt Operations Department. These modules were developed for use in the training of employees on the safety and operational procedures for using an induction furnace. (An induction furnace is used in the manufacture of metal castings; it is specifically used to heat molten iron to the proper temperature).

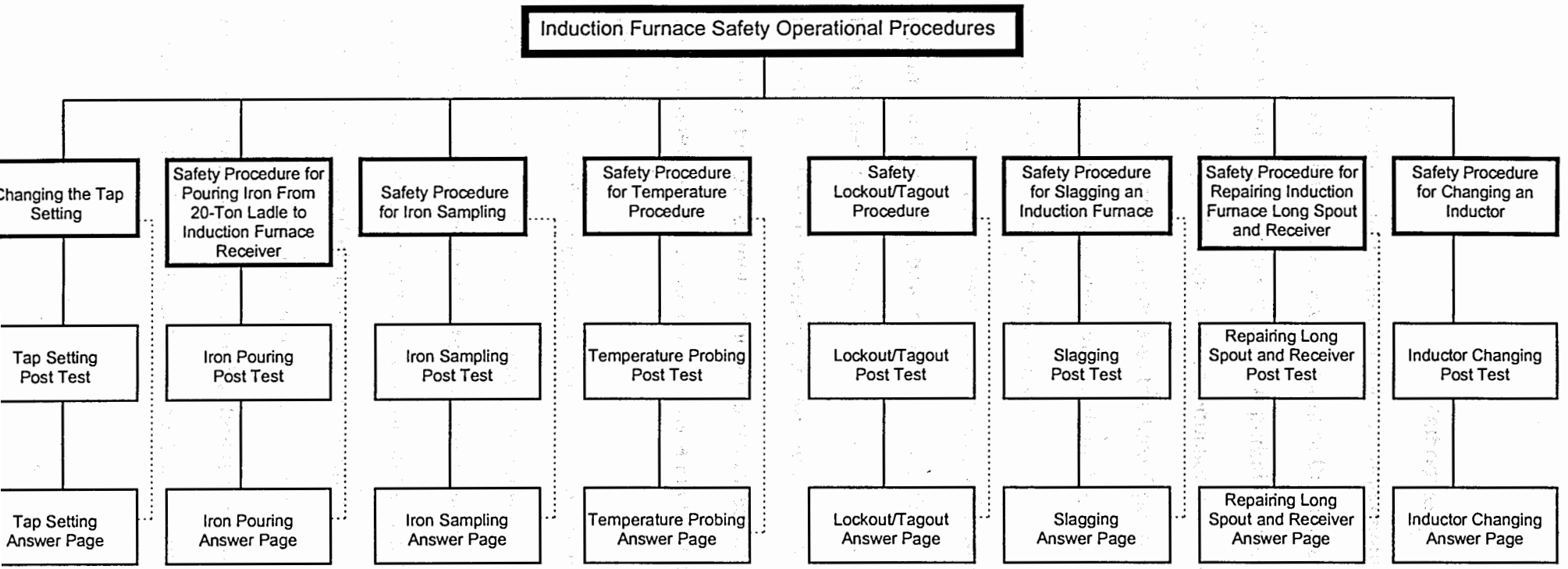
For years, the predominant instructional approaches have been paper-based, self-study, instructor lead approaches. However, in businesses there has been a "shift toward alternative delivery strategies that allow quality improvement and reduce training costs" (Anglin, 1995). The use of multimedia technologies as training tools allows businesses to reduce training time, decrease costs, increase accessibility, provide active learning experiences, and increase safety. As technology becomes more available, affordable and standardized, companies and educational institutions are incorporating interactive multimedia into their training programs (Barron, Orwig, 1995).

The advent of the Internet and the World Wide Web provide vast network resources and tools for learning (Desey 1996). The Web provides a potential base for delivering multimedia not restricted to a specific platform (Boyle 1997). The medium of delivery for the Induction Furnace Safety Operational Procedures Unit is the John Deere intranet. Because the Web is not limited to a particular platform, this provides the most consistent and most widely accessible means of delivery. Furthermore, over time, multimedia delivery is much more cost

effective that human delivery. Instructor-lead training of this material would require 1-2 weeks. The induction furnace tutorial modules can be completed in approximately 1.5 hours cumulatively, and since it is likely that an employees would not cover all eight modules at one time, the instructional time is only a few minutes per training session. Also, for this specific project, in which the instructional material covers procedures that take place in a very dangerous environment, this medium of instruction provides a much safer learning environment.

This instructional unit is intended for use as a supplemental training tool for employees. The units are appropriate for use by newly hired employees, and more experienced employees. New employees would have already been through two weeks of extensive job training, prior to using this material. These units complement some of this training, cover induction furnace-related procedures in greater detail and emphasize the proper procedures for safe operation of equipment. For experienced employees, the units provide review/refresher training. Persons who may have performed a task many times, may take shortcuts that are unsafe. In each module, all safety precautions and steps are shown for their review.

A chart follows illustrating the organization of the page.


Induction Furnace Safety Operational Procedures
Changing the Tap Setting
Safety Procedure for Pouring Iron From 20-Ton Ladle to Induction Furnace Receiver
Safety Procedure for Iron Sampling
Safety Procedure for Temperature Procedure
Safety Lockout/Tagout Procedure
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Iron Sampling Answer Page
Temperature Probing Answer Page
Lockout/Tagout Answer Page
Slagging Answer Page
Repairing Long Spout and Receiver Answer Page
Inductor Changing Answer Page

Methodology

The material in this unit was not documented prior to the development of this project. Therefore, development of the content required a period of observation and documentation. A period of three weeks was spent observing and conversing with experienced induction furnace attendants. The purpose for this was to become familiar with the Melt Operations environment and jargon, as well as to observe the attendant perform the various procedures that were the subject of instructional development.

Following this observation period, there were several days of documentation. This time consisted of continued observation of the induction furnace attendant, coupled with copious note-taking, to record the steps of each procedure. After documenting these procedures, as a formative evaluation measure, the department managers reviewed the documentation of procedures and provided feedback for corrections and insertion of safety precautions into the processes.

After revising/correcting the documentation, photographs were taken of each procedure. This required several weeks of taking pictures while each procedure was performed, showing the subject wearing the proper personal protective equipment and following all steps. After obtaining correct documentation and photographs, the instructional Web site was designed and developed, complete with graphical tutorials and evaluation mechanisms. The instruction was again reviewed by department managers for accuracy and to obtain their feedback about the instructional format.

The learning environment of the instructional unit employs the use of multimedia and hypertext, or hypermedia. Multimedia connotes the combination of more than one modality of information (Desey 1996). Hypertext is a natural enhancement to this, each word or graphic can be linked to some other part of the text, another document, etc...(Kommers, Grabinger, Dunlap 1996). This capability of the WWW as an information delivery system is tailored to fit the instructional strategy of this unit.

Project

This instructional unit was developed in the format of eight (8) Web-based modules located on the John Deere Waterloo Works intranet, Melt Operations site. Each module is designed as a step-by-step graphical representation of a safety or operational procedure in a story-board like format (see Appendix B). Post tests are provided for each tutorial as an evaluation mechanism (see Appendix C). Post test responses are submitted to the Foundry Technology and Metallurgy manager. There are also pages that allow users to check their answers, so that they may review information pertaining to incorrect items (see Appendix D). All pages contain links and navigation icons to assist users in moving from page to page without feeling "trapped in" or "lost". Instructions on the use of the tutorial are also provided prior to use as a guide for persons with minimal computer experience. The components of development for this project are: needs assessment, learner analysis, performance objectives, assessment instruments, instruction revision, instructional strategy, instructional selection/materials, and formative evaluation/instruction revision.

Needs Assessment

The need for this project was identified by the Foundry Technology and Metallurgy Manager. The "gap" for the Melt Operations was that documentation of safe procedures for operating the induction furnace did not exist prior to the development of this project. New employees were taught procedures on the job, generally by a more experienced employee. The deficiencies of this approach to

training are inconsistency, and possibly the passing on of unsafe shortcuts in performing procedures. The format of the needs assessment was an informal interview/discussion with the manager. We discussed past on-the-job injuries that occurred as a result of failure to follow proper safety precautions. He identified eight procedures that are contained in this unit as processes that needed to be documented.

The instructional material was developed to satisfy the following goal: Given (on-line) instructional review of safe operating procedures, learners will be able to identify proper safety practices and procedures with 90% accuracy. The objective of this is an emphasis on safety - a demonstration of safe procedures and proper protective equipment, to foster compliance with these practices while performing job tasks.

Learner Analysis

The induction furnace is operated by an induction furnace attendant. This unit is designed for persons who would occupy this position and/or persons who do repair work on this machinery.

Audience Assumptions:

1. Learners have received two weeks of job training, in which they have had some experience with several of the procedures in this unit.
2. Experienced employees have had hands-on experience with several of the procedures in the unit.
3. Learners are familiar with the technical terms/jargon in this unit of instruction.

4. Learners are motivated to learn the material because it is critical to their health and safety on the job.
5. Learners have reading and comprehension skills of at least a high school graduate level.
6. Learners have received basic computer training as a part of new employee orientation.

Performance Objectives

1. Learners will respond to module post test questions with 90% accuracy.
2. Learners will follow all safety procedures and precautions associated with use of the induction furnace when performing job tasks.

Assessment Instruments

Assessment instruments are included in each module, in the form of post tests which follow the instructional material (see Appendix C). The post tests assess learners' knowledge of correct operational procedures and safety procedures. Learners answer questions to on-line post tests and submit answers.

Instructional Strategy

The content is taught via an on-line tutorial - a step-by-step demonstration of the correct operational procedures, including the proper personal protective equipment (see Appendix B). Learners will utilize this training as directed by departmental managers and supervisors. Learners will go through the training at

standard periodic intervals, and/or in close proximity to times when particular procedures will be conducted on the job. After viewing the tutorials, the post test at the end of each module will be taken to determine the learners' comprehension of the information. Learners' ability to follow all procedures properly will also be assessed by the number of Foundry recordable injuries related to the improper operation of the induction furnace.

Instructional Selection/Materials

Again, the instruction is delivered in the format of an on-line tutorial. Along with the tutorial unit is an instruction sheet for using the tutorial (see Appendix A). These instructions are provided for trainees who have minimal computer experience. The sheet provides directions of how to get to the Induction Furnace Safety Operational Unit on the JD intranet and how to navigate through it. (There are also clear navigation links and icons in the tutorials).

Formative Evaluation/Instruction Revision

Formative evaluation took place throughout the developmental stages of the project, to identify changes need to improve the instructional content and delivery system as it was being developed. There were two means of formative evaluation: supervisors'/managers' critique, and one-to-one learner evaluation. Managers reviewed material for accuracy of content and incorporation of all safety procedures and personal protective equipment. Changes were made

according to their feedback and suggestions. One-to-one learner evaluation consisted of sitting with trainees as they used the instructional unit, to identify problems, observe reactions to content, see initial performance indications, and to get feedback about confusing/vague sentences or other areas in the unit. The one-to-one formative evaluation consisted of these questions:

-Is learning material clear, easy to follow?

-Is the instruction the appropriate level for the target audience?

-Is the module design conducive to easy navigation, or does it make the user feel "trapped in" or lost?

-Do learners have a clear understanding of procedures after viewing the tutorial?

-Do learners feel confident that they could perform the procedures after completing the instruction?

-Is the technical terminology appropriate to learner background?

-What changes could be made to improve the instruction for the learner?

-What areas, if any, are confusing or vague?

As a result of learners' feedback, minor adjustments were made to the wording of some content, and answer pages were added following each post test to allow learners to view the correct answers to questions after taking the post tests. Learners found it easy to navigate through the tutorials, and had a grasp of terms used in the tutorials. Learners' computer skill levels were appropriate for this instructional delivery medium.

Conclusions and Recommendations

Conclusions

Instructional multimedia has become an integral part of training programs in businesses and corporations, and is rapidly enhancing the effectiveness and efficiency of training programs. The primary benefits of the Induction Furnace Safety Operational Unit to the John Deere Waterloo Foundry are: reduced training time, decreased cost, and increased safety. The instructional unit provides a compact unit of several procedures, documented accurately, and deliverable in a much safer environment than the actual Melt area.

The main drawback of the instructional strategy is: maintenance of the instructional unit will be time consuming - the person designated for upkeep of the site has other primary responsibilities. Changes require additional picture taking and programming. Any changes made in equipment, procedures or regulations in the Melt Department would render some components of the instructional unit obsolete. The content could quickly become dated.

Recommendations

For future development of projects of this type, the effectiveness of instruction might be improved by incorporating more interactive, simulation-type activities. The interactivity of this unit exists only in the testing of learners at the end of each unit. An improvement of this would be "virtual" situations that require learners to make decisions about what actions to take in a simulated work environment.

Appendix A

Induction Furnace Safety Operational Procedures
Tutorial Instructions

1. From the John Deere Home Page, click on **Div & Dept**.

2. Then, on the Waterloo Ag - Divisions, Departments and Groups page, click on **Melt Operations**.

3. On the Melt Operations page, click on the procedure you have been directed to go through:

   Changing the Tap Setting

   Safety Procedure for Pouring Iron From 20-Ton Ladle to Induction Furnace Receiver

   Safety Procedure for Iron Sampling

   Safety Procedure for Temperature Probing

   Safety Lockout/Tagout Procedure

   Safety Procedure for Slagging an Induction Furnace

   Safety Procedure for Repairing Induction Furnace Long Spout and Receiver

   Safety Procedure for Changing an Inductor

4. Each tutorial consists of pictures that illustrate each step of the procedure. In order to have a full view of all pictures, the Netscape window must be resized to fit the full size of the computer screen.

   Using the mouse, move the arrow to the upper right corner of the screen. You will see three buttons that look like this:

   

   Click on the middle button  to change the window to the full size of the computer screen.

5. As you read through the tutorial, use the scroll bar on the right to move down the page. 

6. When you get to the bottom of the page, choose to go directly to the post test or return to the top of the page and go through the tutorial again before taking the post test.
   (Example: Click **Proceed to Tap Setting Post Test** -or- **Return to Top of Page**)

7. When taking the post test,
   a. enter your name and position in the spaces provided.
   b. For each item, click in the circle that precedes the answer you choose.

8. Upon completion of the post test,
   a. click on the Click Here to Submit button.
   b. click on the Click Here to Reset button to clear the post test of your name and answers.

9. You may check your answers by clicking on the provided link.

10. If you missed any items, you may review the tutorial by clicking on Review " " Tutorial at the bottom of the answer page.

Appendix B

Induction Furnace Safety Operational Procedures

John Deere Foundry Waterloo
Department 830 Melt Operations

is unit consists of procedure documentation and tutorials for eight (8) induction furnace operations. The tutorials illustrate the steps of each procedure and orporate the safety measures that should be taken while performing each task. The safety operational documents may be printed for use as a personal reference r close attention to the personal protective equipment that is required for each procedure - your safety is at stake!

rsonal Protective Equipment Requirements

Standard and Task Specific PPE

fety Operational Procedures - Tutorials

- Changing the Tap Setting
- Safety Procedure for Pouring Iron From 20-Ton Ladle to Induction Furnace Receiver
- Safety Procedure for Iron Sampling
- Safety Procedure for Temperature Probing
- Safety Lockout/Tagout Procedure
- Safety Procedure for Slagging an Induction Furnace
- Safety Procedure for Repairing Induction Furnace Long Spout and Receiver
- Safety Procedure for Changing an Inductor

fety Operational Procedures - Documents

- Changing the Tap Setting
- Safety Procedure for Pouring Iron From 20-Ton Ladle to Induction Furnace Receiver
- Safety Procedure for Iron Sampling
- Safety Procedure for Temperature Probing
- Safety Lockout/Tagout Procedure
- Safety Procedure for Slagging an Induction Furnace
- Safety Procedure for Repairing Induction Furnace Long Spout and Receiver
- Safety Procedure for Changing an Inductor

Melt Operations Home Page

Please forward your comments to Frank Krone

John Deere Waterloo
Melt Operations

PERSONAL PROTECTIVE EQUIPMENT

Induction Furnace Attendant

THE FOLLOWING STANDARD PPE MUST BE WORN AT ALL TIMES:

- safety glasses with mesh side shields
- hearing protection
- foot protection - metatarsal
- hard hat

THE FOLLOWING PPE MUST BE WORN IN ADDITION TO THE STANDARD PPE LISTED ABOVE WHEN TAPPING IRON INTO THE FURNACE POURING IRON FROM LADLE TO RECEIVER), REPAIRING THE RECEIVER OR LONG SPOUT, OR TAKING IRON AND TEMPERATURE SAMPL

- green duck coat or green sleeves
- leather welder's gloves
- face shield

THE FOLLOWING PPE MUST BE WORN IN ADDITION TO THE STANDARD PPE LISTED ABOVE WHEN SLAGGING THE FURNACE OR USING TH OXYGEN LANCE:

- aluminized coat
- aluminized apron, pants or protective leg shields
- aluminized gloves (or leather welder's gloves)
- shaded face shield

OTHER AVAILABLE PPE FOR WORK NOT SPECIFICALLY LISTED ABOVE:

- terry cloth gloves
- safety harness
- safety goggles

Back to Induction Furnace Main Page

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Tutorial

Changing the Tap Setting

tandard Personal Protective Equipment is required while performing this task.

tep 1.

ap setting control is located on the induction furnace power supply/control panel.
e are two tap changers (one for each inductor on the furnace).

n Furnace power supply/control panel

Tap setting control

ep 2.

changing a tap setting, press the "STOP" button for the MAIN FCE CONTACTOR to shut
's power off. The green "OPEN" light should come on indicating that the power is off. Do not
the tap setting when the red light is on.

"STOP" button

Green "OPEN" light

ep 3.

rnise a tap setting, turn the "Tap Changer" handle to the left until the desired number appears in the "Tap Position" window.
o lower a tap setting, turn the "Tap Changer" handle to the right until the desired number appears in the "Tap Position" window.

r - Turn "Tap Changer" handle to left

Lower - Turn "Tap Changer" handle to right

Tap number appears in "Tap Position" window

ep 4.

finished changing the tap setting, press the "START" button for the MAIN FCE
FACTOR to turn the power back on. The red "CLOSE" light should come on.

ART" button.

Red "CLOSE" light

Proceed to Tap Setting Post Test

Return to Top of Page

Induction Furnace Main Page

Please forward your comments to Frank Krone

Tutorial

Safety Procedure for Iron Sampling

dition to Standard Personal Protective Equipment, a **green duck coat, face shield**, and **leather welder's gloves** required while performing this task.

ep 1.

re beginning this procedure, make sure that the furnace is in the upright position. If it is not, go holding furnace control panel, turn the selector switch to"console." Press and hold down the rn button (PB-16) until the furnace is in the upright position.

ing furnace control panel

Turn selector switch to "console."

own return button.

Furnace in upright positon

p 2.

m the operator's stand, take one chill core wedge and one chill core slug mold. Place them on the stand in front of the furnace slag door - the chill re wedge should be on top of the slug mold, the opening in the chill core wedge should be aligned with the sample cavity of the mold.

r's stand

Chill core wedge

Chill core slug mold

n stand in front of furnace slag door- e on top of slug mold

Chill core wedge opening

Sample cavity of slug mold

p 3.

n chain gate in front of furnace slag door.

g gate

Step 4.

Remove furnace slag door cover and set aside.

Remove cover.

Set aside.

Step 5.

Insert a long-handled sampling cup through the furnace slag door opening and dip out some iron.

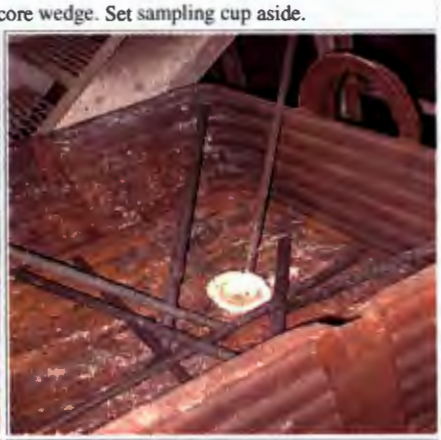
Long handled-sampling cup

Insert into opening and dip out some iron.

Step 6.

Pour the iron from the sampling cup into the chill core wedge. Set sampling cup aside.

Pour into chill core wedge.



Set sampling cup aside.

Step 7.

Replace the furnace slag door probe cover. Close the chain gate.

Replace probe door cover.

Close chain gate.

Step 8.

Take chill core wedge and slug mold to operator's stand.

Chill core wedge and slug mold on operator's stand.

Step 9.

Use metal bar to bust sample out of mold. Place sample piece in bucket of water located near operator's stand to cool.

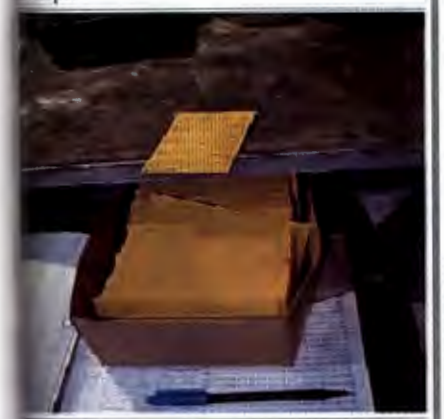
Sample piece

Use metal bar to bust out sample.

Place sample piece in bucket of water to cool.

tep 10.

rom operator's stand drawer, remove a sample nvelope.



e envelope

tep 11.

ove sample from bucket, dry off, and place into envelope. On the outside of the envelope, write letter and number of the furnace from which the sample came (e.g. B2) and also record the time t the sample was taken.

ve sample from bucket.

Place into envelope.

Write furnace number and time on outside of envelope.

tep 12.

ake sample to the metallurgy lab.

Metallurgy lab

Proceed to Iron Sampling Post Test

Return to Top of Page

Induction Furnace Main Page

Please forward your comments to Frank Krone

Tutorial

Safety Procedure for Induction Furnace Temperature Probing

addition to Standard Personal Protective Equipment, a **green duck coat**, **face shield**, and **leather welder's gloves** required while performing this task.

Step 1.

fore beginning this procedure, make sure that the furnace is in the upright position. If it is not go to holding furnace control panel, turn the selector switch to"console." Press and hold down the return tton (PB-16) until the furnace is in the upright position.

lding furnace control panel

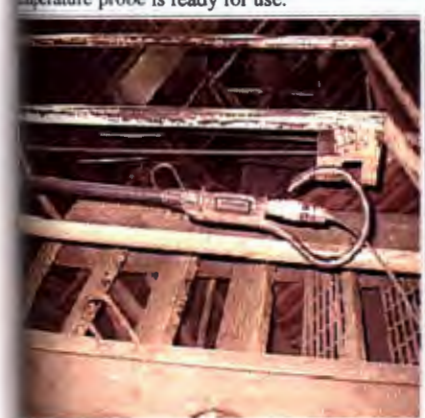
Turn selector switch to "console."

old down return button.

Furnace in upright positon

Step 2.

ttach a disposable thermal couple to the temperature probe. On the temperature display screen, the green light will come on indicating that the mperature probe is ready for use.



mperature probe (handle)

Attach disposable thermal couple

Green light on the temperature display screen

tep 3.

nfasten chain gate in front of furnace slag door.

nfasten chain gate

tep 4.

move furnace slag door cover and set aside.

ve cover.

Set aside.

ep 5.

t the temperature probe thermal couple into the iron. When the probe is placed into the iron, the llow light on the temperature display screen will come on.

t thermal couple into iron.

Yellow light on temperature display screen

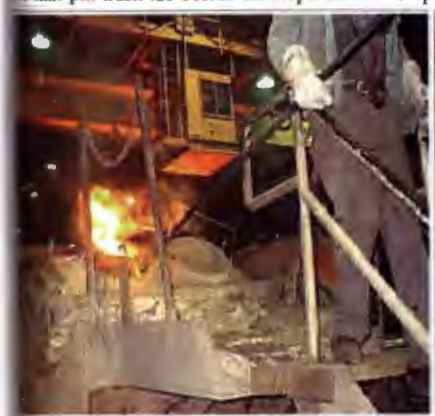
p 6.

n the current temperature has been obtained, d light on the temperature display screen will on, indicating that the temperature check is plete. The current temperature of the iron is displayed.

ed light and temperature on temperature display screen.

Step 7.

Remove probe from iron and detach disposable thermal couple. Discard the used thermal couple in the hair pin trash tub beside the steps. Return temperature probe to its place beside the hand rail.



Remove probe from iron.

Detach thermal couple.

Discard used couple in hair pin trash tub.

Put probe back in place beside rail.

Step 8.

Replace the furnace slag probe door cover. Close the chain gate.

Replace probe cover.

Close gate.

Step 9.

Read current temperature of iron on temperature display screen. Record the temperature and tap information in the induction furnace temperature record book (located in operator's stand).

Temperature display screen

Record temperature and tap information in record book.

Step 10.

Write temperature and time on erasable marker board.

Erasable marker board


Proceed to Temperature Probing Post Test


Return to Top of Page


Induction Furnace Main Page

Please forward your comments to Frank Krone

Tutorial

Induction Furnace Safety Lockout/Tagout Procedure

Step 1.

On Induction Furnace power supply/control panel, press stop button for MAIN FCE CONTACTOR. Green light should come on.

duction Furnace power supply/control panel

Press stop button/Green "open" light

Step 2.

Turn handle of circuit breaker to "TRIP" position.

circuit breaker

Turn handle to "TRIP" position.

Step 3.

(Electricians): Go to substation and rack out the secondary circuit breaker for the induction furnace that is going to be worked on. Turn kirk key and remove it from the lock.

Substation

Breaker door

Rack out breaker

Breaker has been racked out.

Kirk key

Turn kirk key and remove it from lock.

Step 4.

Induction furnace control panel, place kirk key in lock box. Attach personal lock and tag.

Lock box

Place key in lock box.

Attach personal lock and tag.

Step 5.

Press start button for MAIN FCE CONTACTOR to confirm that it will not close. RED "CLOSE" LIGHT SHOULD NOT COME ON!

Press start button. Red "CLOSE" light should not come on!

Step 6.

Check for voltage with volt meter.

Check for voltage.

Proceed to Lockout/Tagout Post Test

Return to Top of Page

Induction Furnace Main Page

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Appendix C

Induction Furnace Post Test:
Changing the Tap Setting

Test: Induction Furnace: Tap Setting

Position:

ctions: Read each statement carefully. Then choose the correct response. After completing the post test, click on **"Click Here to Submit"** to submit your answers. The ck on **"Click Here to Reset"** to clear the post test for the next user.

The tap setting may be changed with the furnace power on.
A. True B. False

The tap setting control is located on the _____.
A. holding furnace control panel B. MAIN FCE CONTACTOR C. induction furnace power supply/control panel

er changing the tap setting, turn the power back on by_____.
A. turning the "Tap Changer" handle to the left B. pressing the "stop" button C. pressing the "start" button

e tap setting is raised by _____.
A. turning the "Tap Changer" handle to the left B. pressing the "stop" button C. turning the "Tap Changer" handle to the right

Click Here to Submit | Click Here to Reset

Click here to CHECK YOUR ANSWERS!

Please forward your comments to Frank Krone

Induction Furnace Post Test:
Safety Procedure for Iron Sampling

t Test: Induction Furnace: Iron Sampling

me:

osition:

ections: Read each statement carefully. Then choose the correct response. After completing the post test, click on **"Click Here to Submit"** to submit your answers. Then ick on **"Click Here to Reset"** to clear the post test for the next user.

Which of the following tools are used in iron sampling?
A. disposable thermal couple, temperature probe ○ B. chisel hammer, Kao-wool, Ladle-well ○ C. chill core wedge, chill core slug mold

When a sample is taken, the size and weight should be recorded on the sample envelope.
A. True ○ B. False

After sample has been taken, the sample piece should be cooled by _____.
A. being placed in front of the fan adjacent to the power supply control panel ○ B. being placed into a bucket of water ○ C. being taken to the metal lab.

Which of the following personal protective equipment is required while taking an iron sample?
. respirator, safety glasses, hearing protection ○ B. green duck coat, face shield, leather welder's gloves ○ C. all equipment listed in both above items

When the sampling procedure is completed, the sample piece should be taken to _____.
A. the metallurgy lab ○ B. the supervisor ○ C. the substation

e chill core wedge and slug mold should be set side by side on the stand in front of the furnace slag door.
A. True ○ B. False

_____ is used to remove iron from furnace.
A. long-handled sampling cup ○ B. slag door probe cover ○ C. bucket

The furnace must be in upright position before performing this procedure.
A. True ○ B. False

Click Here to Submit | Click Here to Reset

Click here to CHECK YOUR ANSWERS!

Please forward your comments to Frank Krone

Induction Furnace Post Test:
Safety Procedure for Temperature Probing

Test: Induction Furnace: Temperature Probing

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ctions: Read each statement carefully. Then choose the correct response. After completing the post test, click on **"Click Here to Submit"** to submit your answers. Then ck on **"Click Here to Reset"** to clear the post test for the next user.

nperature probing requires an aluminized coat, aluminized gloves and protective leg shields.
True ○ B. False

When the thermal couple is first placed into the iron, the _____ light will come on indicating _____.
green, probe is ready for use ○ B. yellow, temperature is being taken ○ C. red, temperature check is complete

A used thermal couple should be discarded in _____.
A. in the hair pin trash tub ○ B. the furnace ○ C. a garbage can

temperature probe is stored _____.
in the doghouse ○ B. beside the operator's stand ○ C. beside the hand rail

When the temperature of the iron has been obtained it should be recorded _____.
A. on the erasable marker board ○ B. in temperature record book ○ C. both A and B

entire temperature probe should be placed through the furnace slag door opening.
A. True ○ B. False

The temperature is displayed on
A. the temperature display screen ○ B. the induction furnace control panel ○ C. the temperature probe handle

_____ must be worn while removing a used thermal couple.
A. green duck coat ○ B. leather welder's gloves ○ C. both A and B

Click Here to Submit | Click Here to Reset

Click here to CHECK YOUR ANSWERS!

Please forward your comments to Frank Krone

Induction Furnace Post Test:
Safety Lockout/Tagout Procedure

t Test: Induction Furnace: Lockout/Tagout

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ections: Read each statement carefully. Then choose the correct response. After completing the post test, click on **"Click Here to Submit"** to submit your answers. Then k on **"Click Here to Reset"** to clear the post test for the next user.

The secondary circuit breaker is to be racked out by_____.
A. the induction furnace attendant. ○ B. an engineer ○ C. the shift supervisor

When the "stop" button is pressed, the red "CLOSE" light should come on.
○ A. True ○ B. False

When the kirk key is removed from the breaker lock, it should be placed _____.
A. in lock box at induction furnace control panel ○ B. in substation ○ C. on operator's stand

The handle of the SCB circuit breaker should be turned to the _____ position.
○ A. OFF ○ B. STOP ○ C. TRIP

efore checking for voltage, the start button for the MAIN FCE CONTACTOR should be pressed to confirm that it will not close.
A. True ○ B. False

Click Here to Submit | Click Here to Reset

Click here to CHECK YOUR ANSWERS!

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Appendix D

John Deere Waterloo
Melt Operations

Home

Post Test Answers:
Changing the Tap Setting

1. The tap setting may be changed with the furnace power on.
B. False

2. The tap setting control is located on the _____.
C. induction furnace power supply/control panel

3. After changing the tap setting, turn the power back on by
C. pressing the "start" button

4. The tap setting is raised by _____.
A. turning the "Tap Changer" handle to the left.

Please return to tutorial to review information on incorrect answers!

Review Tap Setting Tutorial

Return to Induction Furnace Main Page

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John Deere Waterloo
Melt Operations

Home

Post Test Answers:
Safety Procedure for Iron Sampling

Which of the following tools are used in iron sampling?
chill core wedge, chill core slug mold

When a sample is taken, the size and weight should be recorded on the sample envelope.
False

After sample has been taken, the sample piece should be cooled by _____.
being placed into a bucket of water

Which of the following personal protective equipment is required while taking an iron sample?
all equipment listed in both above items

When the sampling procedure is completed, the sample piece should be taken to
the metallurgy lab

The chill core wedge and slug mold should be set side by side on the stand in front of the furnace slag door.
False

A _____ is used to remove iron from the furnace.
long-handled sampling cup

The furnace must be in the upright position before performing this procedure.
True

Please return to tutorial to review information on incorrect answers!

Review Iron Sampling Tutorial

Return to Induction Furnace Main Page

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John Deere Waterloo
Melt Operations

Home

Post Test Answers:
Safety Procedure for Temperature Probing

Temperature probing requires an aluminized coat, aluminized gloves and protective leg shields.
A. False

When the thermal couple is first placed into the iron, the _____ light will come on indicating _____.
A. yellow, temperature is being taken

A used thermal couple should be discarded in
A. the hair pin trash tub

The temperature probe is stored _____.
A. beside the hand rail

When the temperature of the iron has been obtained, it should be recorded
A. both A and B

The entire temperature probe should be placed through the furnace slag door opening.
A. False

The temperature is displayed on the
A. temperature display screen

_____ must be worn while removing a used thermal couple.
A. both A and B

Please return to tutorial to review information on incorrect answers!

Review Temperature Probing Tutorial

Return to Induction Furnace Main Page

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John Deere Waterloo
Melt Operations

Home

Post Test Answers:
Safety Lockout/Tagout Procedure

The secondary circuit breaker is to be racked out by _____.
3. an engineer

When the "stop" button is pressed, the red "CLOSE" light should come on.
3. False

When the kirk key is removed from the breaker lock, it should be placed _____.
4. in lock box at induction furnace control panel

The handle of the SCB circuit breaker should be turned to the _____ position.
2. TRIP

Before checking for voltage, the start button for the MAIN FCE CONTACTOR should be pressed to confirm that it will not close.
1. True

Please return to tutorial to review information on incorrect answers!

Review Lockout/Tagout Tutorial

Return to Induction Furnace Main Page

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